


 <https://zen.yandex.ru/media/id/5e4ac3dd5033cf582d873b74/87-proekciia-na-fon-lunnoi-go...>

 8 min read

87. The projection on the background of the lunar mountain went directly to the astronauts. Where are the actors' shadows?

They write to me in the comments: *Let's say that NASA took lunar images using the front projection method in the pavilion. If the slide projector cast a view of the lunar mountain onto the screen and shone directly on the astronaut, then there should be a shadow behind the astronaut in the photographs. Why, then, are the edges of the shadows from the module, astronaut, etc. not visible?*



Дмитрий

Насчет того, что не видно гор на скафандре - это понятно стало после разъяснений автора, а вот почему не видно каемок теней от модуля, астронавта и т.д. на экране фронтпроекции? Если астронавт стоит недалеко от оси объектива проектора, тени на экране за ним не будет видно, но если он чуть в стороне, тень должна появляться, по крайней мере, фигура астронавта с одной стороны на фото должна иметь черную каемку (часть тени от фигуры на экране). Автор ранее как раз писал, что наличие такой тени как раз и выдает метод фронтпроекции в кино, полностью ее удалить довольно сложно.

Well, the question is reasonable. And it certainly arises for those who want to understand the features of front projection. It is not difficult to answer it, because in recent years we have resorted to front projection several times, and we still have the working moments of the arrangement (relative to the movie screen) of the projector, camera, mirror and actors.

Here is a shot that was taken during the filming of the TV movie "[The Big Space Lies of the USA](#)" (Zvezda TV Channel, 2016). The Moon Mountain is projected onto the vertical

plane of the screen, and a shadow of a person is visible on this screen. How to make it so that the shadow is not visible?

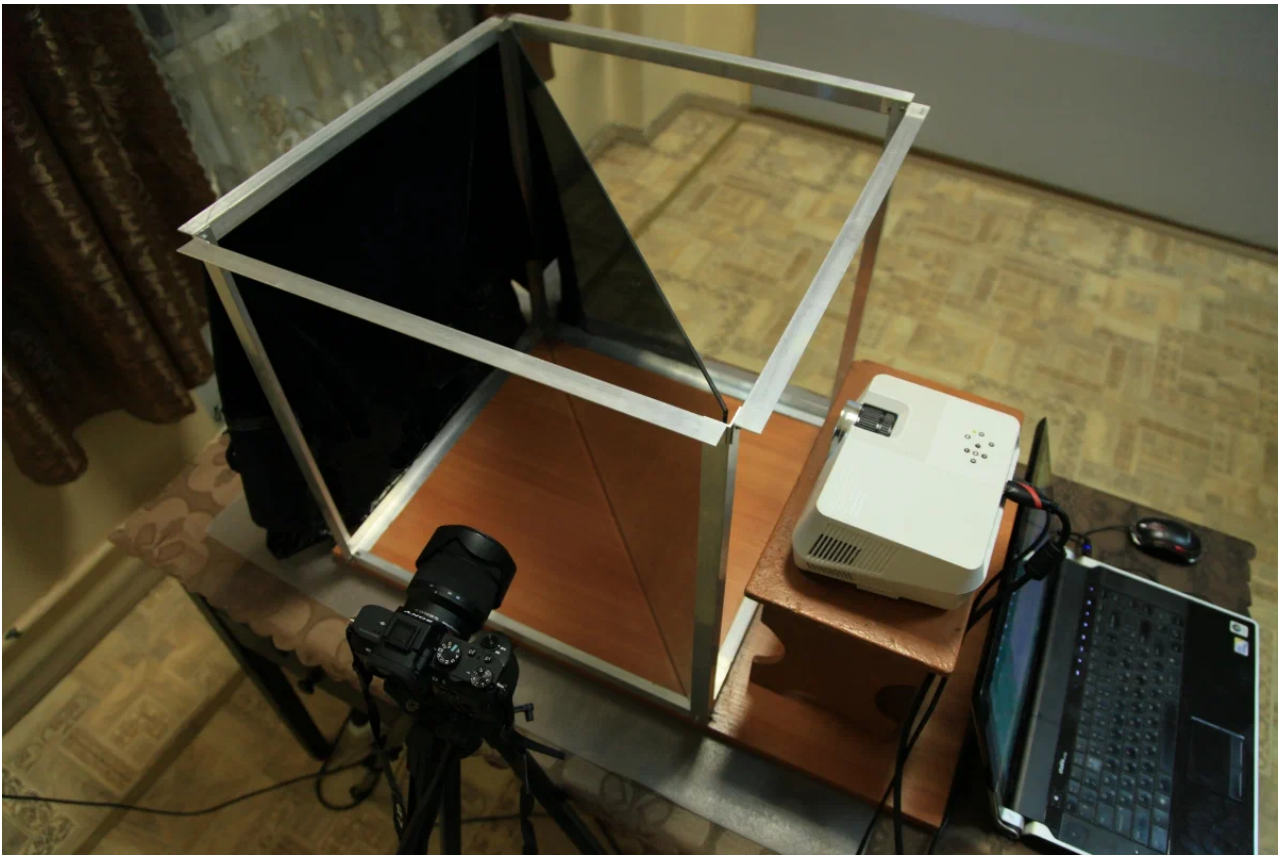


"Lunar" mountain is projected onto a movie screen.

"Lunar" mountain is projected onto a movie screen.

From a theoretical point of view, it is elementary and simple. You need to place the camera lens in the same place as the light source. But since it is impossible to do this in practice - to put 2 lenses in the same place at once - a projector and a camera, then the **reflection of** the projector lens in a **semitransparent** mirror is combined with the camera lens .

In practice, it looks like this: the projector and the camera, separated by a translucent mirror, are at the same height. The camera, through a mirror that transmits 50% of the light, "looks" at the screen.



The location of the camera, projector, black velvet and screen in front view. In the upper right corner there is a reflective screen.

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Approximately 50% of the light is reflected by the mirror at a 90 degree angle towards the screen and creates an image on the screen. The other 50%, which goes straight through the mirror, are not used. Black velvet is set in their path.



The translucent mirror reflects the glowing projector lens. This luminous circle is combined with a camera lens seen through a semitransparent mirror.



For a better understanding, we have placed two photos below - when the lenses are apart and when they are aligned.



Projector and camera lenses separated

Projector and camera lenses separated

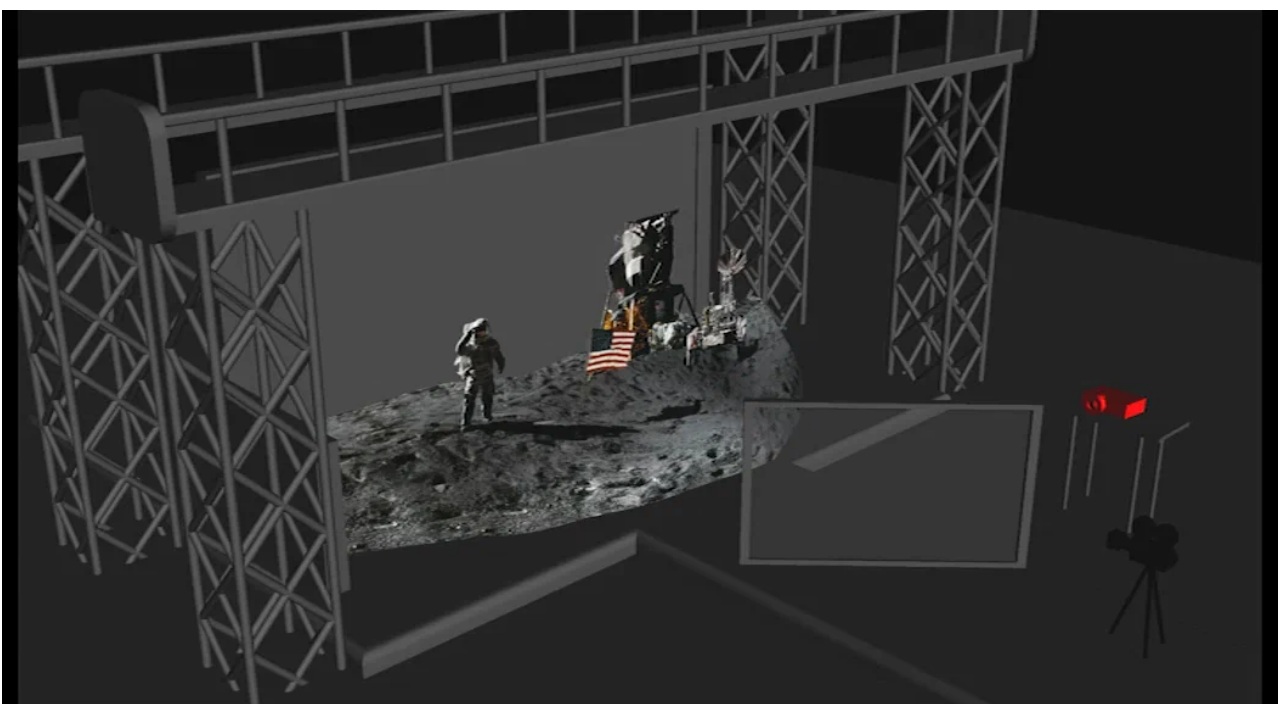


Lenses of the projector and the camera are combined

Lenses of the projector and the camera are combined

And now it turns out that the projector lens is exactly in the same place as the camera lens.

Let's trace on the diagram how the shadow is hiding. First, the projector is turned off. The reflective screen is located 5-6 meters behind the actor's back and looks like a gray canvas. The camera and projector are on a separate platform in front.



Front projection circuit, video projector off.

Front projection circuit, video projector off.

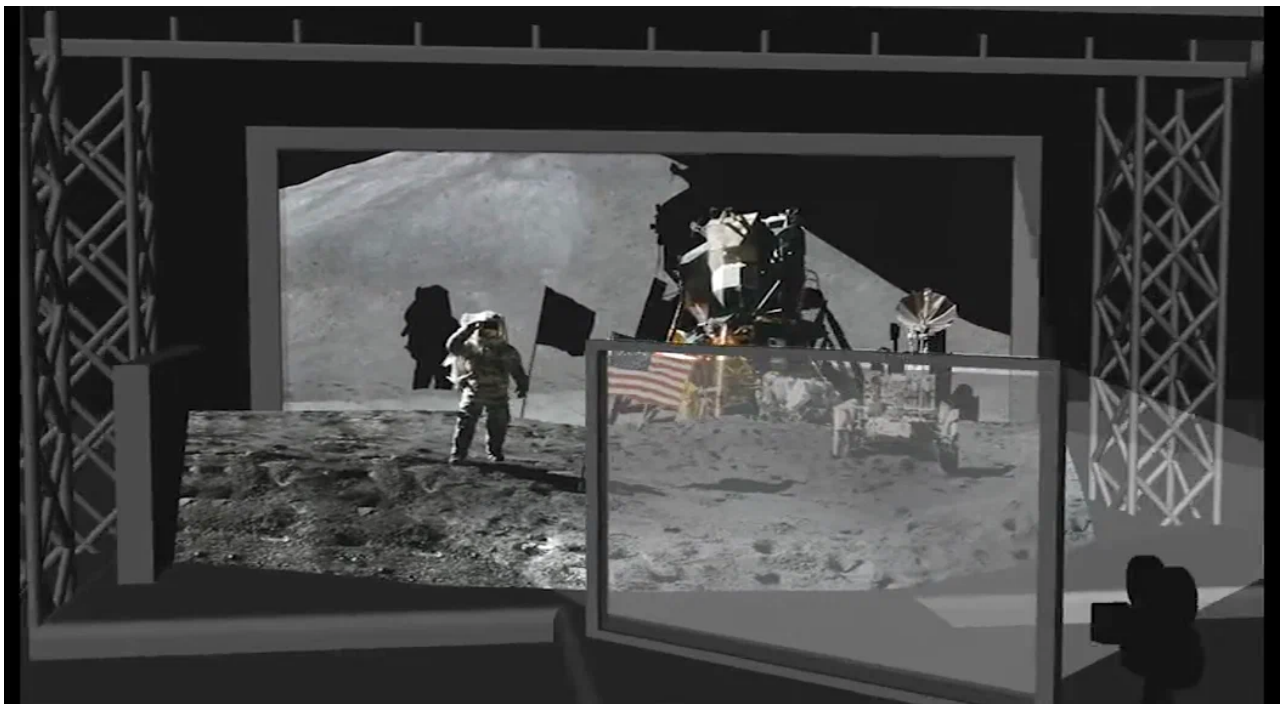
When the projector is turned on, a shadow appears behind the actor. Since we are looking from the side point, we see this shadow at a distance from the actor. We see the shadow from the flag and from the lunar module.



Front projection circuit, video projector included. A shadow appeared on the screen.

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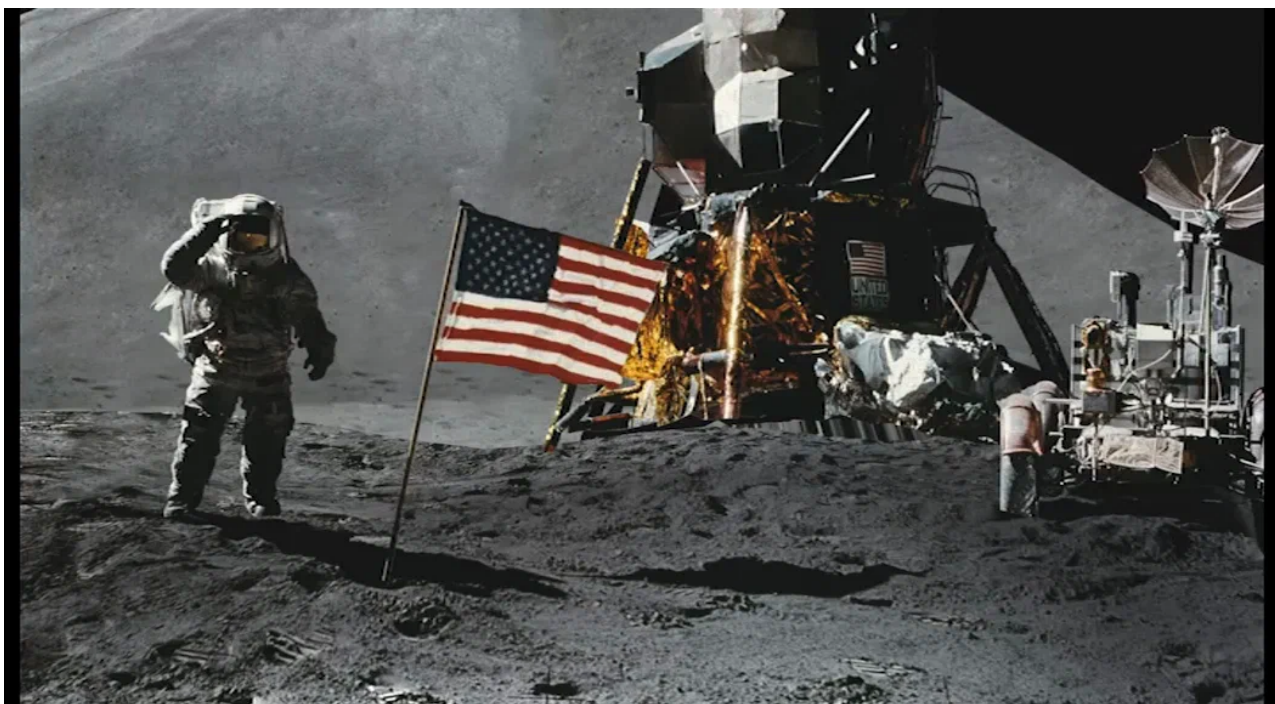
As you get closer to the camera, the shadow is aligned with the subject.



When we got pretty close to the camera's point of view, the shadows almost disappeared behind the objects.



And this is how the shooting camera sees:



This is how it looks on [video](#):

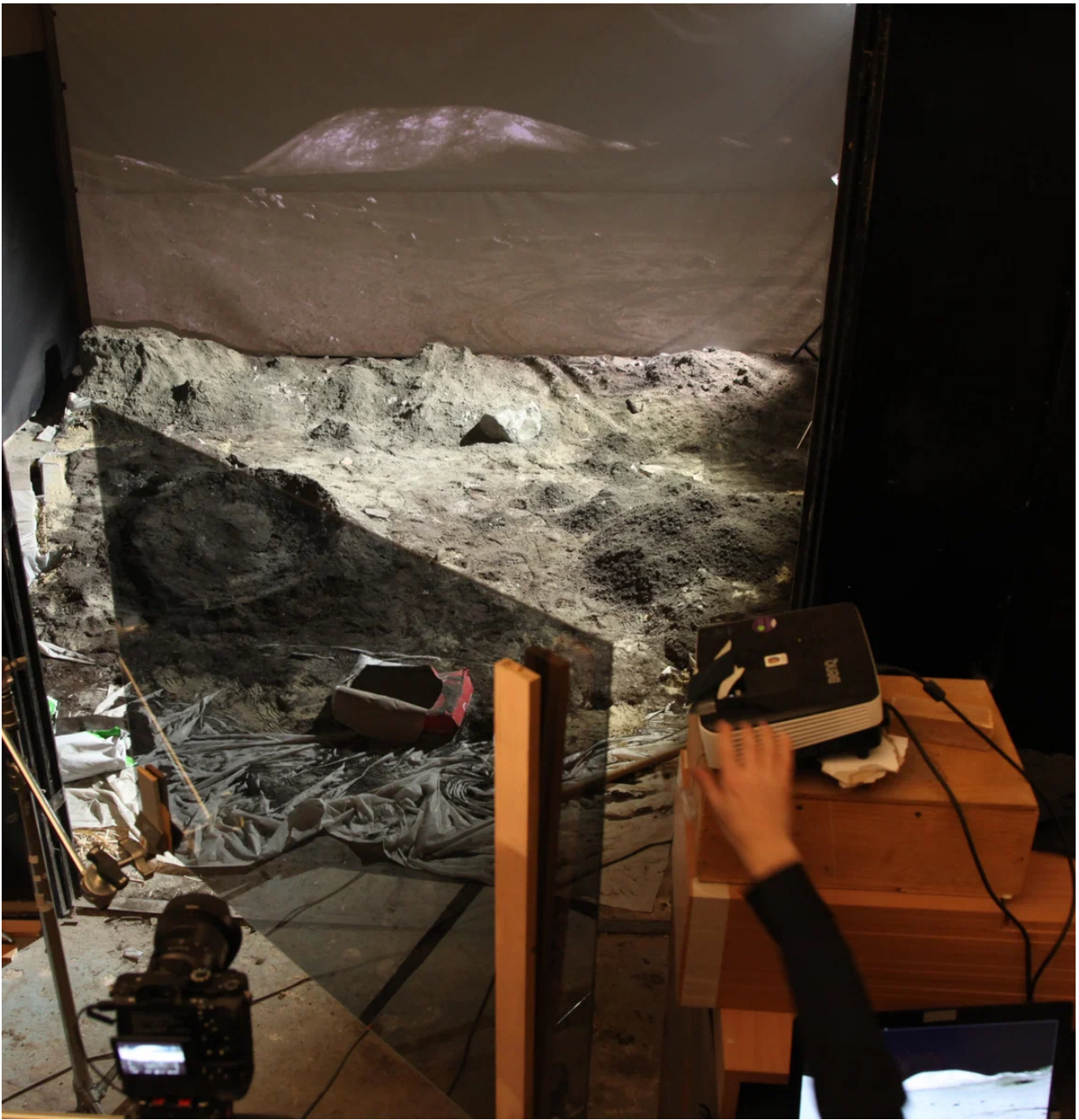
Такие комбинированные съ



And don't forget yet! For an observer from the side, the illumination on the screen is about 100 times lower than the illumination of the game scene. That is, during the shooting, the side observer on the screen does not see anything at all. Only the operator sees from one single point.

Here's a look at what the image looks like on the reflective screen during tune-away and what the screen looks like during operation.

Now the image on the screen is visible to everyone around. The image is being adjusted. On the monitor of the camera (see in the lower left corner), the upper part of the frame is very highlighted, which means that too much light is being supplied to the screen from the point of view of the camera.



Reconstruction of the process of combining the mountain on the projector with the foreground landscape.

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In the photo, you can see how a hand reaches into the projector to lower the glass gray filter onto the lens.



On the left, the gray filter is up, on the right, the gray filter is blocking the lens.

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This filter reduces the luminous flux by about 30 times.



Glass gray filter.

Glass gray filter.

After the gray filter is lowered onto the projector lens, the screen goes blank. An outside observer no longer sees anything there. But for the camera, this is exactly the illumination that is needed for correct exposure. Now the correct brightness ratio is formed on the camera monitor.



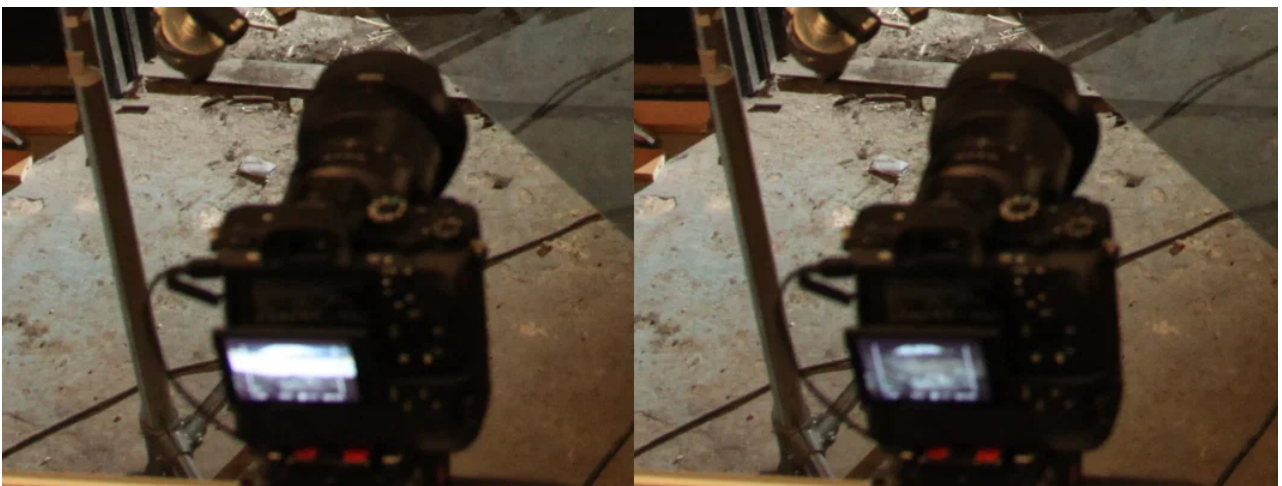
The gray filter is lowered onto the projector lens - this is the operating mode.

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This is what the camera sees:



A reflective screen requires very little light, about 100 times less than a traditional white screen, since this screen does not scatter light in all directions, but directs the light from the projector to exactly one place. And a camera is put in this place.



Cutting from two shots. On the right, a gray filter is installed in front of the projector lens.

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We wrote about this in the previous article: ["86. If NASA used front projection in lunar images, why can't the light from the slide projector be seen on the suits?"](#)

We could use our projector to illuminate a screen 30 times larger in area. In our case (for the TV movie "The Great Space Lies of the United States"), a screen 5 meters wide was used, but we could easily enlarge the image onto a screen up to 25-28 meters wide. In other words, to use the same gigantic screen that S. Kubrick had in "A Space Odyssey". And for this we would not need hundreds of kilowatts of light that Kubrick had.

You will ask why? Because our digital camera had a sensitivity of 1250 units (and 1600 units), while Kubrick had film with a sensitivity of only 125 units. In those years, 55 years ago, this sensitivity of a color film, 125 units, was considered high. And such a film required a lot of light.

So, in this article we described the way how to combine the lens of the projector and the lens of the shooting camera during front projection in order to hide the shadows. Probably now, in order to complete the description of the front projection, one should answer the question, is it possible to pan during front projection? We will talk about this in the next article "How we used front projection in the play".

*

Cameraman L. Konovalov was with you. Until next time!